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ABSTRACT

The Comprehensive Instructional Management System (CIMS)-Science program is designed to support teachers in teaching the "New York State Elementary Science Syllabus." The curriculum emphasizes a hands-on inquiry approach to learning and includes an assessment component comprised of written tests and performance-based tests, designed to assess student mastery of the content and process. This report is divided into four sections. The first section provides background and implementation information for the program and describes the program evaluation methodology. The CIMS-Science program was piloted during the 1988-89 school year in kindergarten through grade 2 in five schools each and expanded in subsequent years. The second section summarizes the CIMS approach to science education and describes the program's activities related to staff development and curriculum revision. The third section reports the evaluation of the program. Questionnaires to 53 classroom teachers and interviews with 7 lead science cluster teachers explored teachers' use and assessment of the revised program, the support provided, and program impact on teachers and students. Based on the findings, the following recommendations were made: (1) program, district, and school staff should continue to collaborate in revising the CIMS-Science curriculum incorporating suggestions by classroom teachers and science cluster teachers; (2) consideration should be given to exploring alternative or "authentic" assessment strategies that assess problem solving skills; and (3) classroom teachers should observe science cluster teachers demonstrating lessons using a discovery-based approach to prepare them to assume primary responsibility for science instruction. (MDH)

# OREA Report

COMPREHENSIVE INSTRUCTIONAL MANAGEMENT
SYSTEM (CIMS)-SCIENCE
1991-92

COMPREHENSIVE INSTRUCTIONAL MANAGEMENT
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1991-92

# NEW YORK CITY BOARD OF EDUCATION



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7/7/92

EXECUTIVE SUMMARY

The Comprehensive Instructional Management System (CIMS)-Science program is designed to support teachers in teaching the New York State Elementary Science Syllabus. The curriculum emphasizes a hands-on inquiry approach to learning that incorporates process skills and science content objectives. The program also includes an assessment component comprised of written tests (except for kindergarten and grade one) and performance-based tests, designed to assess student mastery of the content and process objectives, respectively. Teachers are expected to use the assessment results to guide instructional planning.

Community school districts (C.S.D.s) 8, 17, and 25 piloted CIMS-Science during the 1988-89 school year in kindergarten through grade two in five schools each. In subsequent years, C.S.D.s 8 and 25 expanded the program to additional schools and grades; C.S.D. 17 continued to use the program, but only in kindergarten through grade two in the five original pilot schools.

Since 1990-91, all elementary schools in C.S.D. 8 have been using the program in kindergarten through grade four. In addition, district resources have been committed to revising the curriculum and assessment components, as well as to staff development, since the program was first introduced. The 1991-92 evaluation of CIMS-Science by the Office of Research, Evaluation, and Assessment (OREA) focused on the status of the program in this district in view of its level of commitment to it.

Questionnaires to classroom teachers in a sample of ten schools and interviews with selected lead science cluster teachers explored teachers' use and assessment of the revised program, the support provided, and program impact on teachers and students.

Overall, classroom teachers judged the revised CIMS-Science curriculum as a comprehensive, useful guide to instruction which incorporates the required learning objectives and is engaging for students. Suggestions for further improvement stressed the need for background information for teachers and additional materials for children. Lead science cluster teachers recommended that lessons promote greater integration of science with other subject areas. While both groups of respondents acknowledged the efforts on the part of central CIMS and district staff to make the manipulative materials necessary for implementing the hands-on activities more readily available, they expressed the need for more help in this regard.

Teachers were generally less enthusiastic about the assessment components, and not all reported using them. For the most part, the written tests were considered more useful for determining student mastery of science content than for evaluating their problem-solving skills. Complaints about the guided studies, intended for assessing the development of process skills, centered largely around problems related to administering them. Some teachers expressed a preference for assessing students' performance within the context of actual learning situations, and reported using both observations and discussions.

These views are consistent with the national trend toward performance-based or "authentic" assessment, which emphasizes the effective application of knowledge and skills in addressing meaningful tasks, demonstrations of competence within realistic contexts, and interaction with others for the purpose of justifying one's views and reflecting on the perspectives of others. This approach toward assessment also stresses the importance of considering student performance in varied situations over an extended period of time, and opportunities for students' self-assessment.

Both classroom teachers and lead science cluster teachers reported receiving substantial support this year for science education from the central CIMS-Science coordinator, the district science coordinator, and school principals. Most teachers said that the CIMS-Science program had increased their confidence in teaching science, and promoting their students' interest in this subject.

Based on the findings of this report, OREA makes the following recommendations:

- Program, district, and school staff should continue to collaborate in revising the CIMS-Science curriculum in ways already initiated, incorporating additional suggestions of classroom teachers and science cluster teachers, particularly with regard to more extensive background materials for teachers and additional materials for children. In view of the importance of manipulative materials to the program's hands-on approach and the lack of sufficient funds to supply all needed materials, consideration should be given to purchasing only priority items and focusing staff development on helping teachers find more realistic ways of compensating.

- Given teachers' continued resistance to using the program's assessment components and their preference for strategies that depend more on assessing performance within the context of actual learning situations, consideration should be given to exploring alternative or "authentic" assessment strategies. This might include projects that provide opportunities to assess students' ability to solve problems, as opposed to activities that call for the demonstration of isolated skills. Use of science journals, in which students are encouraged to reflect upon and write about their learning experiences, could foster the development of critical thinking and promote the integration of science with language arts, other important program goals.

- In order to further encourage classroom teachers to assume primary responsibility for science instruction and to help them implement a discovery-based approach, there should be more opportunities for them to observe, and perhaps assist with, a variety of hands-on lessons conducted by science cluster teachers. To further extend this opportunity to learn from others, teachers on the same grade level might observe each other teach those lessons or topics with which they are most comfortable, combining their classes on occasion to facilitate scheduling, if possible.

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# I. INTRODUCTION

## PROGRAM BACKGROUND

### Description

The Comprehensive Instructional Management System (CIMS)-Science program is designed to support teachers in teaching the New York State Elementary Science Syllabus. The curriculum emphasizes a hands-on inquiry approach to learning and is based on an organized sequence of process skills--e.g., observing, classifying, measuring, estimating, predicting--which are taught in conjunction with content objectives in life science, earth science, and physical science. Each area of study is presented in an instructional module. Different topics and increasingly sophisticated problem-solving skills are addressed in successive grade levels. The program also includes an assessment component comprised of written end-of-module tests (except for kindergarten and grade one) and performance-based tests, designed to assess student mastery of the content and process objectives, respectively. To assist teachers in assessing the development of students' science process skills, the CIMS program includes a guided study kit (including appropriate manipulative materials) which teachers use to observe each student's performance on various direct experience activities. Teachers are expected to use the results of both forms of assessment to determine students' strengths and weaknesses, and to modify instruction accordingly.

## History of Implementation

Community School Districts (C.S.D.s) 8, 17, and 25 piloted CIMS-Science during the 1988-89 school year, each targeting five schools tc implement the program in kindergarten through grade two. During subsequent school years, C.S.D.s 8 and 25 expanded the program to additional schools and grade levels. By 1990-91, all of C.S.D. 8's elementary schools were using CIMS-Science in kindergarten through grade four; in C.S.D. 25, 13 schools expanded the program to grade four, while most of the other schools in the district had introduced it in kindergarten through grade two. C.S.D. 17 continued to use the program, but only in kindergarten through grade two in the five original pilot schools.

## PROGRAM IMPLEMENTATION DURING 1991-92

Use of CIMS-Science continued in the original three districts during 1991-92 with no further expansion to other schools or grade levels. However, lack of funds for staff development (e.g., to hire district-based CIMS staff developers or to provide release time for teachers) or for the purchase of materials (particularly manipulatives and consummables for laboratory activities) impeded program implementation. According to the district science coordinators, weaknesses inherent in the curriculum also hindered its use. While the hands-on, discovery-based approach was emphasized in C.S.D.s 17 and 25, CIMS-Science was not followed explicitly, but used more as an auxiliary. To what extent and for what specific purposes it was used by teachers was not known by science coordinators in these districts, although they suspected it was not used extensively.

In C.S.D. 8, despite similar obstacles to implementation, much effort has been directed at revising the curriculum and assessment components (ongoing for several years), and the revised CIMS materials were being used (in conjunction with other materials) in kindergarten through grade four in the district's 19 elementary schools during the 1991-92 school year. Staff development activities conducted by the central CIMS-Science coordinator, district science coordinator, and a group of "lead" science cluster teachers (selected from district schools and released during the school day with funds provided by the district) included training in the use of these materials. Moreover, in nearly all C.S.D. 8 schools, classroom teachers, in conjunction with science cluster teachers, were expected to assume responsibility for science instruction; to facilitate articulation between them and to assure coverage of the required curriculum, the district developed pacing charts.

EVALUATION FOCUS

Earlier OREA have evaluations focused on program implementation in C.S.D. 25 (except for the pilot year which included all three districts). Overall, the findings have indicated that the CIMS-Science manual is useful for teaching the elementary science curriculum, particularly for teachers without strong science backgrounds. The strengths of the program, according to teachers, are the curriculum's hands-on approach, specificity, and flexibility. Teachers have also observed that the program promotes student interest in science, as well as the development of important skills. Criticism has focused largely on the unavailability of manipulatives (crucial for a hands-on approach), and the inadequate coverage or omission of some topics.

Reactions to the assessment components (designed for diagnostic purposes) have generally been less positive--in part because of problems related to administering them, and because test results were of limited use in guiding instructional decisions.

The program has been most successfully implemented where there has been strong district and school support--e.g., commitment of money for a district-based staff developer (with matching funds from central CIMS), released time for staff development, and the purchase of the requisite materials.

Since commitment to CIMS-Science in 1991-92 appeared to be greatest in C.S.D. 8, the current evaluation explored the status of the program in this district. Issues examined included the nature of the curriculum revisions that have been made; teachers' use and assessment of various program components; the support provided by central CIMS-Science, district, and school staff; and the impact of the program on teachers and students.

EVALUATION METHODOLOGY

In spring 1992, OREA mailed questionnaires to classroom teachers of kindergarten through grade four in a sample of C.S.D.

8 elementary schools (N=10 out of 19). The schools were selected in collaboration with the district science coordinator to reflect a geographical cross section of the district. Interviews were also conducted with seven of the district's 12 lead science cluster teachers, the district science coordinator, and the central CIMS-Science program coordinator.

## SCOPE OF THIS REPORT

This report of the CIMS-Science program consists of four parts. Chapter I provides an overview of the program's history and implementation during 1991-92, and describes the focus of the current investigation and the evaluation procedures. Chapter II summarizes the approach to science education and to the CIMS program in C.S.D. 8. The perceptions of program participants are presented in Chapter III, and Chapter IV offers conclusions and recommendations.

## II. APPROACH TO SCIENCE EDUCATION AND CIMS IN C.S.D. 8

In order to provide a context within which the experiences of classroom and lead science cluster teachers with CIMS-Science can be better understood, following is a summary of the approach to science and major program-related activities in C.S.D. 8--i.e., curriculum revisions and staff development.

### DISTRICT POLICIES AND PROCEDURES

The district has adopted an approach to science that emphasizes direct hands-on experiences to help children develop core understandings (based on New York City and State Essential Learning Objectives--E.L.O.s), the use of inquiry skills to solve problems, and respect for nature. Teachers are encouraged to integrate science with other subject areas and to incorporate students' everyday life experiences into science instruction. In addition, science center activities, basic to the early childhood program, are intended to provide students with group learning opportunities. Two periods of science instruction per week are mandated in kindergarten, three periods in grades one to three, and four periods in grade four.

All district schools have science cluster teachers who served as resources to classroom teachers. Their responsibilities typically included administrative tasks such as ordering and distributing materials, providing staff development, and teaching science lessons. The results of guided study assessment and written tests were used not only at the school level as a guide to instruction, but by the district science coordinator to determine the kinds of revisions needed and areas in which schools needed further assistance.

CURRICULUM REVISIONS

Although C.S.D. 8 initially chose to implement CIMS-Science because the program's process-oriented approach is consistent with the district's educational philosophy, problems with the program prompted their revising and supplementing it in various ways. Foremost among the weaknesses of the curriculum noted by the district's science coordinator were the following: insufficient background information for teachers; poorly developed and inadequate variety of lessons; omission of important topics; poor correlation of lessons with E.L.O.s; insufficient and poorly designed worksheets; and absence of science center activities and homework. Problems related to the written tests centered on factual errors and poor correlation with the content of the instructional modules. The guided studies were faulted for neglecting to assess students' ability to *use* science process skills to solve problems, focusing as they do on mastery of these skills *per se*.

Revision activities in the district were directed at redressing these problems, and involved the district science coordinator, in collaboration with a group of lead science cluster teachers--selected because of their interest and experience in science.

Another obstacle teachers have faced in using CIMS-Science has been the unavailability of manipulatives necessary for hands-on activities, particularly consummables. While C.S.D. 8 allocated Elementary and Secondary Education Act monies for schools to buy basic materials, and some grade levels relied to a large extent on materials from commercial publishers, the science coordinator acknowledged that this was only "a drop in the bucket"; the district's goal is for each teacher to have a kit with all needed materials. In support of this goal, parents in some schools have undertaken the task of fundraising.

STAFF DEVELOPMENT

Staff development in science was provided by various sources. The district science coordinator and central CIMS-Science coordinator conducted workshops for teachers, visited classes, and met with teachers individually. School-based science cluster teachers not only shared instructional and assessment responsibilities with teachers, but helped them to implement effective lessons, especially those involving laboratory activities. The district paid for the release of clusters (and school supervisors) during school time to attend weekly workshops provided by the central CIMS and district science coordinators; the clusters were expected to offer turnkey training to teachers in their schools. School supervisors were expected to observe lessons, in part to make sure that teachers completed all units and that students utilized science process skills. In addition to contributing to curriculum revision, the lead science cluster teachers participated in designing and conducting district-based staff development activities, thus serving classroom teachers in other schools as well as their own. Because of limited funds, however, most teacher training was offered after school on a voluntary basis, although science was addressed during mandated early childhood staff development days.

OTHER DISTRICT SCIENCE ACTIVITIES

The district's sponsorship of various science programs and activities reflects its support of science education. These include development of a grade three reading/science program (currently in two schools), which uses both CIMS and district-developed materials and encourages parent involvement; a family science program operated in conjunction with The City College of New York; and the planned development of an English as a Second Language complement to CIMS-Science.

## III. PERCEPTIONS OF PROGRAM PARTICIPANTS

### DESCRIPTION OF RESPONDENTS

A total of 58 teachers of grades K-4 completed the questionnaire sent to them by OREA (representing a response rate of 24 percent). Most respondents had taught elementary level science for five or more years, while 11 percent had only one to two years of experience.

The seven lead science cluster teachers who were interviewed had taught science at the elementary level for at least three years; three of these teachers had seven or more years' experience. Their interest in science was reflected in various ways, including graduate coursework in science, attendance at district-sponsored and other science education training, and previous participation in science-related curriculum revision or staff development activities. (Only one lead cluster teacher was not currently teaching science, although he continued to conduct after-school science workshops.) All lead cluster teachers had used the CIMS-Science program for several years, most since its introduction during the 1988-89 school year.

### SCIENCE ROLES AND RESPONSIBILITIES

#### Instructional Roles of Classroom Teachers and Science Clusters

In describing their overall approach to teaching science, classroom teachers most often referred to using "hands-on" or "discovery" strategies; some emphasized making science "fun" for children. The vast majority of teachers (89 percent) reported that, on average, their students received between three and four periods of science instruction per week (in all but a few instances this met or exceeded the district requirement for the grade), and most teachers (66 percent) shared this responsibility with the science cluster teacher in their school. (All but one lead science cluster teacher, who taught computer science this year, assumed some instructional responsibilities in their own school.)

One goal of the program and the district was to encourage classroom teachers to assume primary responsibility for teaching science--in part, to promote a more integrated approach to instruction--and for science cluster teachers to serve largely as sources of assistance and support. Accordingly, OREA explored the nature of the relationship between these school staff.

While no clear pattern was discernible in how classroom and science cluster teachers shared responsibility for science instruction, they did divide lessons and, in most cases, the cluster teacher seemed to make the decision regarding who would assume responsibility for what. Some lead science cluster teachers described how they made these decisions. Two said they taught those topics that the classroom teacher did not feel comfortable with, while another generally introduced the unit and the teacher, who saw the children every day, was responsible for ongoing activities like charting the weather. Still another lead cluster teacher tended to do the hands-on lessons, while the classroom teacher learned by observing her; in this case, the classroom teacher did more of those activities involving reading stories with the children. Last year, according to one lead cluster teacher, she and the classroom teacher taught different lessons on the same topic, but this year they divided the topics because they found the other method to be ineffective. Some classroom teachers reported that they conducted the laboratory and assessment activities, while others said that the science cluster teacher assumed this role. Clearly, no one strategy was used, and some experimented with different approaches.

There were also variations with respect to the number of periods per week each taught--in some cases the classroom teacher assumed greater responsibility for instruction, while in others the science cluster teacher taught most of the lessons. While reaffirming that "participation on the part of the classroom teacher is crucial," one lead cluster teacher explained that the science cluster teacher "is sometimes pressured to cover all of the curriculum" because of the teachers' other responsibilities.

The lead cluster teachers agreed that the district pacing charts were useful, both for clarifying respective areas of responsibility and for ensuring coverage of the required science curriculum. Knowing what topics each was covering and when, they pointed out, made it possible to "keep people on task," "enrich if you want," and "plan ahead." That teachers would, for the most part, be at the same point in the curriculum at any given time, one respondent noted, also made it easier to coordinate staff development.

Non-Instructional Role of Lead Science Cluster Teachers

The lead science cluster teachers assumed dual roles--i.e., they were both the science cluster teacher in their respective schools (although some schools had more than one science cluster teacher--each responsible for different grades), and key participants in district-based curriculum revision and staff development activities. (Only one lead cluster teacher was not involved in curriculum revision during 1991-92.)

Responsibilities as in-school science clusters. In their capacity as a staff developer in their own school, the lead science cluster teachers asserted that they helped classroom teachers in using hands-on activities, integrating science with other subjects, incorporating everyday life experiences into science instruction, and helping children to use process skills to solve problems. To assist teachers, and particularly new teachers, they also conducted workshops on administering the guided studies and using the results, along with other assessment data, to guide instruction. Most lead science cluster teachers maintained that they did not administer the guided study assessments, explaining that district policy required classroom teachers to assume this responsibility; nevertheless, some acknowledged that they, and not the classroom teacher, conducted the assessment activities.

Other ways in which the lead clusters supported the teachers in their respective schools centered around their role as a resource person--e.g., recommending reference and enrichment materials, suggesting sites and related activities for class trips, providing materials or showing teachers how to make them, and coordinating science fair projects.

District staff development responsibilities. In describing their participation in staff development beyond that provided as part of their role as their school's science cluster teacher, the lead clusters typically referred to the workshops and demonstration lessons they gave for other school staff in C.S.D. 8, some of which were designed specifically for new teachers or supervisors. Overall, the content of these staff development activities was similar to that of the workshops they conducted in their respective schools, although some sessions addressed ways of involving families in science instruction and integrating science with other subject areas. One lead cluster teacher reported having discussions with junior high school and high school staff to address ways of upgrading science education at these school levels.

## CURRICULUM REVISION

### Focus of Revisions

In order to better understand the nature of the curriculum revisions made by C.S.D. 8, OREA asked the lead science cluster teachers to describe what specific changes were made and how these addressed the perceived deficiencies or weaknesses of the CIMS-Science program.

Instructional objectives and activities. A major focus of the revisions was the addition of required state and city objectives or topics that had not been included at all in the original version, or had been covered superficially. In order to facilitate the teaching of the required content and process objectives, more lessons and science center activities were added, including multicultural activities (e.g., songs about animals in languages spoken by New York City's public schoolchildren) and lessons that relate to the urban environment in which these students live.

In addition to providing a greater variety of activities, lessons were designed to be more comprehensive and to provide a more logical, step-by-step guide to instruction. Consequently, each revised lesson included background information, definitions of relevant vocabulary, a problem statement, a list of needed materials and appropriate quantities, a motivational component, student worksheets, and extended activities such as homework and related reading assignments. As one lead cluster teacher put it, "We added more meat to the skeleton." Some changes were also made in the pacing charts--e.g., extending the suggested number of lessons and time needed to cover certain topics, and reordering certain modules so that activities dependent on a particular season of the year could be carried out.

Guided studies. Changes in the guided studies were largely directed at making them easier for teachers to administer--e.g., making directions more specific, modifying impractical procedures, making substitutions in some of the manipulatives, and eliminating ambiguous or otherwise problematic wording.

*Written tests.* While most of the lead clusters could not comment on revisions made in the written tests (presumably because they were not involved with them), those who did noted efforts to make the questions more concise, to improve the illustrations, to modify the layout, and to make sure that topics emphasized on the tests were also stressed in the curriculum.

## OTHER REVISIONS NEEDED

Since revision of the CIMS curriculum and assessment components is an ongoing process, lead science cluster teachers were asked what additional revisions, if any, are needed, either in the program or the way it is implemented. Apart from acknowledging the need to continue to make the kinds of revisions that have already been made--i.e., making further refinements or extending the changes made to other topics or lessons--and providing teachers with more background information and manipulatives, the lead clusters made other recommendations for program improvement. These included the following: integrating science with other curriculum areas in all grade levels (in kindergarten there are activities that relate science with language arts); providing more reference materials, including some for students, such as trade books with science content; coordinating the pacing charts more closely with the school calendar and developing more realistic time frames for covering topics; ensuring that lessons don't require skills beyond the grade level; evaluating children's skills periodically rather than only at the end of the module; and affording lead clusters more time to work with teachers, especially to model hands-on lessons.

TEACHERS' PERCEPTIONS OF REVISED CURRICULUM

In view of the priority given in C.S.D. 8 to rectifying the perceived weaknesses of the CIMS-Science program, one questionnaire item asked classroom teachers the extent to which they agreed or disagreed that a series of statements describing the revised curriculum were accurate. As Table 1 indicates, more than three-fourths of the respondents (ranging from 77 to 98 percent) agreed with seven of the eight positive characterizations--chiefly that it is well correlated with the E.L.O.s, relates science to everyday life experiences, fosters positive attitudes toward science, and promotes development of inquiry skills. About half (51 percent) agreed that it provides sufficient background information.

The major strengths of the revised CIMS-Science curriculum, according to those teachers who addressed this issue (n=28), centered around their perception that it was a helpful, easy-to-follow guide for teachers (n=18), was motivating for children (n=9), and was appropriate in its content (n=5). Some sample comments:

- "It is very clear and covers a lot of material. The hands-on approach makes the program very effective."
- "Children love it and are more involved."
- "Very easy for teachers to implement and follow."
- "Considering how little time we have, having lessons already made up is terrific."

TABLE 1

Percentage of Teachers Agreeing with Positive Descriptions of the Revised CIMS-Science Curriculum

| | Assessment | |
|---|---|---|
| Description | Mostly Agree | Somewhat Agree |
| Is well correlated with Essential Learning Objectives | 55 | 43 |
| Relates science to everyday life experiences | 38 | 49 |
| Fosters positive student attitudes toward science | 44 | 42 |
| Promotes development of inquiry skills | 39 | 46 |
| Includes lessons for required content areas | 33 | 45 |
| Offers variety of activities for student learning | 45 | 32 |
| Encourages integration of science with other subject areas | 29 | 48 |
| Provides sufficient background information for teachers | 21 | 30 |

- More than three-fourths of the respondents (ranging from 77 to 98 percent) agreed with seven out of eight positive characterizations of the revised CIMS-Science curriculum; a smaller majority (51 percent) believed that it provided sufficient background information.

- "It gives specifics on how and what to teach."
- "It breaks down ideas for children to understand."
- "It's a balanced, comprehensive, flexible program."
- "Children enjoy the hands-on aspect."
- "Lessons are on students' level, and vocabulary is age-appropriate."
- "I like the hands-on approach and scope of the kindergarten curriculum."

Weaknesses (identified by 23 respondents) revolved around problems related to the teacher's manual and instructional materials for children (n=11), the assessment components (n=7), and the program's level of difficulty (n=5). Among teachers' specific complaints were the following: insufficient background information for teachers; lack of a glossary or workbooks for students; poor illustrations; the fast pacing of the curriculum; unclear explanations of lab activities and terminology; guided assessments were too time-consuming and difficult to administer; inappropriateness of written tests for second grade; and dependence of guided studies on students' verbal skills.

AVAILABILITY OF MATERIALS

Another issue explored by the evaluation was the availability of the manipulative materials, particularly in light of the program's emphasis on hands-on experiences as a vehicle for learning and the district's efforts to remedy this problem. About half of the respondents (53 percent) said that such materials were readily available in their school this year. Those who said they were generally not available (or were available only some of the time) typically compensated by borrowing materials from colleagues, bringing items from home, buying materials at their own expense, or by "improvising"-- e.g., making them or drawing pictures.

REVISED ASSESSMENT COMPONENTS

Most teachers of grades 2 to [illegible] (75 percent) reported using the district-developed CIMS-Science written tests this year. (There were no written tests for kindergarten or grade 1.) In assessing their usefulness, a larger majority of respondents found them useful for assessing student mastery of content (75 percent) than for evaluating students' use of process skills to solve problems (59 percent). (Teachers who did not use the written tests usually said that they hadn't received them or that the science cluster gave the tests.)

About half of the respondents (51 percent) acknowledged administering the guided studies, and most of these teachers (60 percent) considered them useful, primarily for identifying areas requiring reteaching. Other purposes for which respondents used assessment results were to reinforce or review topics already taught, and to group students for instruction. Those teachers who explained why they made little or no use of these test results (n=9) commented primarily on the lack of time to do so in view of other curriculum priorities, or the failure of the tests to discriminate sufficiently because they were too easy. In describing other assessment strategies used to monitor student progress, teachers, for the most part, said they relied on observations (n=12), verbal questioning and discussion (n=8), and teacher-made tests (n=6). Many of their comments revealed greater faith in making judgments in actual, rather than contrived, situations--i.e., when children were actively engaged in science activities. Following are some of the alternative techniques used:

- "I observed children working and experimenting with different materials to see how well they're doing. Also, I asked questions for understanding of concepts."
- "Teacher observation of children's enthusiasm and self-motivation to experiment, research, and follow-up on their own."
- "Participation in daily lessons, responses."
- "I try to assess children when they are working at a science center project. And I discuss their progress with the science cluster and usually observe them several times while they're in his class.
- "Individual questioning and large group discussions to elicit responses and examples of each child's knowledge of the subject."
- "Discussions that linked previously taught material to materials being introduced."
- "Science projects that we do as a class. We have a question that children hypothesize about, and then we proceed to prove the hypotheses true or false."

## STAFF DEVELOPMENT AND OTHER ASSISTANCE

Close to two-thirds (64 percent) of the teachers said that they had received staff development or other assistance related to science this year; for the most part it was provided by the district science coordinator and science cluster teacher (each was cited by a majority of the respondents). Another considerable source of help was fellow teachers, mentioned by 41 percent of individuals answering this question. Less than 10 percent of the teachers cited the central CIMS-Science coordinator or their school supervisor. It should be noted, however, that the staff development provided by the central CIMS-Science coordinator was directed primarily at science cluster teachers who, in turnkey fashion, were expected to share what they learned with classroom teachers in their respective schools. It is not likely, therefore, that classroom teachers would have had many opportunities to receive assistance directly from the CIMS-Science coordinator.

While relatively few respondents received help from school supervisors, nearly two-thirds (62 percent) commented on ways in which their principal supported science instruction this year. This typically consisted of purchasing needed materials and equipment (n=20), emphasizing the importance of science (n=10)--e.g., by supporting the science fair and science center, encouraging teacher participation in staff development (n=8), and providing for the science cluster position (n=8).

Lead science cluster teachers, too, were asked about the support demonstrated for science education this year by central CIMS, C.S.D. 8, and school administrators and supervisors. Their responses attest to a high degree of encouragement and practical assistance from all groups.

The central CIMS and district science coordinators were credited with providing invaluable assistance, including staff development for teachers, lead clusters, and school supervisors related to the use of CIMS; help in securing needed materials; arranging for teachers' participation in training programs sponsored by The City College of New York and the Bronx Zoo; securing funds for trips; and being receptive to the need for program revisions. One lead cluster teacher commented on the advocacy role played by the district science coordinator, who had been instrumental in securing cooperation from school principals for certain science activities and who was in other ways responsible for "cutting through the bureaucracy." Support for science on the part of the district superintendency was noted, as well.

School support typically consisted of making monies available for materials and equipment, and providing release time and flexible scheduling arrangements for staff development. However, only one lead cluster teacher made reference to direct instructional support from the school principal--new this year--and this took the form of monitoring the pacing of instruction and the submission of assessment results to the district.

ADDITIONAL SUPPORT

Requests for additional support (expressed by half the responding classroom teachers) focused largely on the need for improved or supplementary materials for teachers and students, including student textbooks, more background information, an answer key, more clearly defined lesson aims, references for follow-up and enrichment activities, grade-appropriate glossaries, expanded workbooks, visual aids, and manipulatives for hands-on lessons. Some teachers wanted help with the guided studies which are administered to children individually, and assistance in organizing and conducting lab experiments. As one teacher put it, " I would have liked another pair of hands."

With regard to their own professional development, teachers asked for more training in the hands-on approach to science and a greater variety of teaching strategies for meeting the diverse needs of their students.

PROGRAM IMPACT

More than half of the respondents (60 percent) said that CIMS had increased their confidence in teaching science, largely by providing a "structured," "step-by-step" guide that is "practical and easy to follow." In the words of one teacher, "CIMS is like a cookbook--it allows me to feel comfortable with an area I was not comfortable with before." This sentiment was echoed by another teacher who explained, "I feel very comfortable knowing exactly what to teach." While acknowledging CIMS' usefulness, however, several respondents expressed the view that without sufficient materials and training it was not a complete program. The need to compensate for this was the reason other teachers gave for claiming that CIMS has had little or no effect on their confidence in teaching science. Others simply said that they had always enjoyed teaching this subject.

Most respondents (76 percent) contended that CIMS had promoted students' interest in science, noting in particular their enjoyment of the hands-on aspects, which engaged them actively in learning. Another feature that teachers saw as motivating for children was its focus on everyday experiences. As expressed by one teacher, "They are more aware and observant of things around them...[and] are anxious to connect what they have learned to new things they see and hear." Heightened student interest was accompanied, in the opinion of two-thirds of the respondents, by improved achievement, attributed by some specifically to the hands-on nature of the curriculum.

# IV. CONCLUSIONS AND RECOMMENDATIONS

The three districts that piloted the CIMS-Science program in 1988-89--C.S.D.s 8, 17, and 25--continued to use the program during the 1991-92 school year, although lack of funds for staff development or materials and weaknesses in the curriculum itself impeded its implementation, particularly in C.S.D.s 17 and 25. In these districts, the program was not followed explicitly, but used more as a supplement.

While C.S.D. 8 encountered similar obstacles to implementation, the program was used in all elementary schools in kindergarten to grade 4. In addition, district efforts to revise the curriculum and assessment components, initiated several years ago, continued. The district also allocated funds for the purchase of manipulative and other science materials. Staff development was provided by the central CIMS-Science coordinator, the district science coordinator, and school-based science cluster teachers--some of whom were designated as lead science cluster teachers, and as such also participated in various curriculum revision and district-based staff development activities.

In view of the considerable commitment to science education in C.S.D. 8, and to the CIMS-Science program in particular, the 1991-92 evaluation by OREA focused on the status of the program in this district.

Curriculum revision focused largely on ensuring that required state and city curriculum objectives were adequately addressed, and providing a variety of comprehensive, easy-to-follow lessons with background information for teachers and extended activities for children. Changes in the guided studies were similarly directed at making them easier for teachers to administer, and at determining students' ability to apply science process skills in solving science problems. Factual errors in the written tests were corrected and test items correlated more closely with the content emphasized in the curriculum.

Overall, classroom teachers judged the revised CIMS-Science curriculum as a comprehensive, useful guide to instruction which incorporates the required learning objectives in science and is engaging for students, who particularly enjoy the hands-on activities. Respondents' suggestions for improving it stressed the need for more background information for teachers and additional materials for children, such as glossaries and workbooks with improved illustrations; some teachers also believed the pacing of the instruction was too fast.

The lead science cluster teachers generally concurred, recognizing that the efforts already taken to address these deficiencies needed to be refined and extended. In addition, they recommended that lessons be designed to promote greater integration of science with other subject areas. While both classroom and science cluster teachers acknowledged the concerted efforts on the part of central CIMS and district staff to make manipulative materials more readily available, they continued to express the need for more help in this regard.

Teachers were generally less enthusiastic about the assessment components, and not all reported using them. Nevertheless, most of those teachers of grades 2 to 4 who gave the written tests did consider them useful for assessing students' mastery of content; a smaller majority found them helpful for evaluating the use of science process skills for solving problems. Fewer teachers, overall, administered the guided studies, although most of those who did found them useful --primarily for identifying areas requiring reteaching. Teachers' complaints about the guided studies centered around the inordinate amount of time required to administer them, difficulties associated with having to test students individually, and the failure of the results to sufficiently discriminate among skill levels.

Moreover, teachers seemed to prefer to assess student performance within the context of actual learning situations--e.g., while they are involved in science center activities or group discussions. These situations also offered teachers opportunities to observe student initiative and capacity for independent learning.

These views are consistent with the national trend toward performance-based or "authentic" assessment, which emphasizes the effective application of knowledge and skills in addressing meaningful tasks, demonstrations of competence within realistic contexts, and interaction with others for the purpose of justifying one's views and reflecting on the perspectives of others. This approach toward assessment also stresses the importance of considering student performance in varied situations over an extended period of time, and opportunities for students' self-assessment.

Both classroom teachers and lead science clusters acknowledged that the central CIMS-Science coordinator, district science coordinator, and school principals provided much support this year for science education. Most teachers reported receiving staff development in use of the program, help in securing materials, and other assistance, primarily from the district science coordinator and science cluster teacher. Although few respondents received instructional support from school supervisors, principals were credited with providing release time and flexible scheduling arrangements for staff development, making money available for materials, and generally emphasizing the importance of science. Lead science cluster teachers also paid tribute to the invaluable assistance and support afforded by the central CIMS-Science and district science coordinators.

Most teachers said that CIMS-Science had increased their confidence in teaching science and promoted their students' interest in this subject; they noted in particular that the hands-on activities involved students actively in the learning process, and that the curriculum made use of children's everyday experiences.

Based on the findings of this report, OREA makes the following recommendations:

- Program, district, and school staff should continue to collaborate in revising the CIMS-Science curriculum in the ways already initiated, incorporating additional suggestions of classroom teachers and science cluster teachers, particularly with regard to more extensive background information for teachers and additional materials for children. In view of the importance of manipulative materials to the program's hands-on approach and the lack of sufficient funds to supply <u>all</u> needed materials, consideration should be given to purchasing only priority items and focusing staff development on helping teachers find more realistic ways of compensating.

- Given teachers' continued resistance to using the program's assessment components and their preference for strategies that depend more on assessing performance within the context of actual learning situations, consideration should be given to exploring alternative or "authentic" assessment strategies. This might include projects that provide opportunities to assess students' ability to <u>use</u> process skills and content area knowledge to solve problems, as opposed to activities that call for the demonstration of isolated skills. Use of science journals, in which students are encouraged to reflect upon and write about their learning experiences, could foster the development of critical thinking and promote the integration of science with language arts, other important program goals.

- In order to further encourage classroom teachers to assume primary responsibility for science instruction and to help them implement a discovery-based approach, there should be more opportunities for them to observe, and perhaps assist with, a variety of hands-on lessons conducted by science cluster teachers. To further extend this opportunity to learn from others, teachers on the same grade level might observe each other teach those lessons or topics with which they are most comfortable, combining their classes on occasion to facilitate scheduling, if possible.